WHAT IS CLAIMED IS:

1. A control and operating system for at least one piezoelectric actuator having an impedance of a substantially capacitative type, in particular for a fuel injector for a Diesel engine, including

- a source of DC supply voltage,

- at least one control circuit branch connected in parallel to the said source and in which the piezoelectric actuator is connected in series to first and second controlled electronic switches each of which has a respective diode connected in parallel, disposed with its cathode towards the positive pole of the voltage source;

- at least one energy-accumulating inductor with one terminal connected between said switches and the other terminal connected to a terminal of the voltage source; and

- electronic command and control means for piloting the said controlled switches so as to cause

* closure of a first switch while the other or second switch is open, so as to connect the accumulator inductor to the voltage source;

* opening of the said first switch when the energy accumulated in the inductor has reached a predetermined value, so that the inductor is then connected to the piezoelectric actuator by means of the diode in parallel with the second switch so as to form a resonant LC circuit, and voltage is progressively located on the piezoelectric actuator operable to cause a reversible mechanical deformation thereof;

* subsequent closure of the second switch while the first is open, so as to allow the voltage located on the piezoelectric actuator to be discharged into the inductor, and

* the reopening of the said second switch when the voltage on the actuator has fallen to a minimum value, in such a way that the residual energy accumulated in the inductor can then flow back towards the voltage supply source.

2. A system according to Claim 1, in which the said command and control circuit means are operable to control the said first switch to close for a period which is a function of the desired value of voltage to be reached on the piezo-actuator.

3. A system according to Claim 1, in which the said command and control circuit means are operable to control the aforesaid first and second switches in such a way as to:

* cause the first switch to close for a predetermined period of time corresponding to a maximum value of voltage to be reached on the piezoelectric actuator and then to cause the first switch to open in order to enable the actuator to be connected to the said inductor, until this maximum value of voltage is reached on the actuator,

* cause at least a first closure of the second switch so as to cause a partial discharge of the voltage accumulated on the actuator into the inductor, until reaching an operating voltage of a pre-established value on the actuator, and then to open the said second switch, and

* after a predetermined period of time, to cause the second switch to close again thereby causing the voltage accumulated on the actuator to discharge into the inductor and the said second switch to re-open for a last time when the voltage on the actuator has fallen to the said minimum value, so that the residual energy accumulated in the inductor can flow back towards the voltage supply source.

4. A system according to Claim 1, in which, for use with a piezoelectric actuator the electrical capacity of which varies, and in particular which increases with the temperature, the said command and control means are operable to cause voltage on the actuator to decrease as the temperature increases.

5. A system according to claim 1, in which in the said control circuit branch the piezoelectric actuator is connected on one side to the positive pole of the voltage supply source and on the other to the series of first and second switches, and the inductor has one terminal connected to the positive pole of the voltage supply source and the other terminal connected between the said switches.

6. A system according to claim 1, in which, in the said control circuit branch, the piezoelectric actuator is connected on one side to the negative pole of the voltage supply source and on the other to the series of the said first and second switches, and the accumulator inductor has one terminal connected to the negative pole of the voltage supply source and the other terminal connected between the said switches.

7. A system according to Claim 1, in which in the said control circuit branch the piezoelectric actuator is interposed between the said first and second switches, and the accumulator inductor has one terminal connected to the negative pole of the voltage supply source and the other terminal connected between the piezoelectric actuator and the said first switch.

8. A system according to claim 1, in which the said switches are MOSFET transistors and the associated parallel diodes are the respective intrinsic diodes.

9. A system according to Claims 4 and 8, in which the said command and control means are operable to deduce the temperature by detecting the resistance between the drain and the source of the MOSFET transistor acting as the first said switch.

10. A system according to claim 1, in which the said energy-accumulating inductor includes a core of ferro-magnetic material, preferably sintered.

11. A system according to claim 1, in which the said voltage supply source includes a battery connected to a voltage booster and stabilizer circuit operable to provide an output supply voltage of a higher value than that provided by the battery.

12. A system according to claim 1, in which the said voltage source is operable to provide a DC supply voltage with a nominal value of about 42V.

13. A system according to Claim 1, for the coordinated control of a plurality of piezoelectric actuators, in particular for controlling a corresponding plurality of fuel injectors;

the system including a corresponding plurality of control circuit branches connected to each other in parallel and also to the said voltage source, a respective piezoelectric actuator being arranged in each control circuit branch in series with associated first and second electronic

switches with a respective parallel diode and a respective energy accumulating inductor connected between the said switches and a terminal of the said voltage source.

14. A system according to Claim 1, for controlling a plurality of pairs of piezoelectric actuators in particular for controlling a corresponding plurality of pairs of fuel injectors;

the system including a corresponding plurality of control circuit branches connected to each other in parallel and connected to the said voltage source; each control circuit branch including

a first and a second portion connected to each other in parallel, a piezoelectric actuator being disposed each in series with a respective second controlled electronic switch; and

a third portion connected in series to the said first and second portions and which includes a first common controlled electronic switch;

each pair of piezoelectric actuators having an associated common inductor, which can be connected to the voltage source by means of the first common electronic switch.

15. A system according to Claim 1, in which the accumulator inductor and the electronic switches and the diodes associated with the or each piezoelectric actuator are incorporated into the piezoelectric actuator thereby forming a single integrated assembly or device.

16. A system according to Claim 15, in which the or each integrated assembly further includes one or more of the following additional means:

- means for acquiring the voltage developed in operation on the piezoelectric actuator;

- means for acquiring the current flowing in operation through the associated energy accumulating inductor;

- means for acquiring the voltage across the terminals of the associated first electronic switch;

- control circuits for the said first and second electronic switches respectively.

17. A system according to Claim 16, in which the additional means are connected to a control and diagnostic device which are adapted to interface with a control unit by means of a control and diagnostic bus.

18. A system according to Claim 1, in which the or each piezoelectric actuator has a respective associated memory, preferably of a rewritable type, for the calibration data of the electromechanical characteristic of the actuator.